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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/510,599	03/18/2005	Michel Lecomte	20513-00607-US	1793

30678 7590 08/31/2007
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EXAMINER	
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ART UNIT	PAPER NUMBER
3663	

MAIL DATE	DELIVERY MODE
08/31/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/510,599	Applicant(s) LECOMTE, MICHEL	
	Examiner Johannes P. Mondt	Art Unit 3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 07 June 2007.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 5 and 11-19 is/are pending in the application.

4a) Of the above claim(s) 12-16 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 5, 11 and 17-19 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Amendment filed 6/7/07 in response to Notice mailed 5/11/07 in conjunction with Arguments/ Remarks filed 2/26/07 and 6/7/07 form the basis for this Office Action. Applicant amended claims 5 and 11, and added new claims 15-19. Claims 1-4 and 6-10 have been cancelled and claims 12-14 have been withdrawn.

Comments on said Arguments/Remarks are included below under "Response to Arguments".

Election/Restrictions

Upon careful consideration of new claims 15-19, claims 15 and 16 are being withdrawn for being directed to a non-elected invention due to the recitation of bypasses in the secondary circuit (see lines 4 and 11, respectively, from below, in claims 15 and 16), with reference to the election by Applicant of Species 1 not Species 2 (see Response filed 9/15/06 to Election/Restriction Requirement).

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

1. ***Claim 19*** is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim contains subject matter not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use

the invention. In particular, a secondary circuit that is both (1) "entirely closed" and (2) the at least one pressure equalizing valve connected to both the primary circuit and the secondary circuit and (3) claimed to "continuously equalize" the pressures in the first heat-exchange fluid and the secondary portion of the steam generator, is inconsistent and impossible, complete closure and continuous equilibration through a valve being mutually exclusive properties of any circuit. In particular, the only pressure-equalizing valve capable of regulating or in any way influencing the pressure in the first heat exchange gas is valve 20. However, valve 20 connects immediately to the secondary circuit and hence cannot be included without said secondary circuit not being "entirely closed".

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. ***Claim 19*** is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, whether or not the secondary circuit is open or closed is rendered indefinite: In particular, a secondary circuit that is both (1) "entirely closed" and (2) the at least one pressure equalizing valve connected to both the primary circuit and the secondary circuit and (3) claimed to "continuously equalize" the pressures in the first heat-exchange fluid and the secondary portion of the steam generator, is inconsistent and impossible, complete closure and continuous equilibration through a valve being mutually

exclusive properties of any circuit. Because the secondary circuit as claimed can be said to be both entirely closed and not entirely closed, the claim is indefinite.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. ***Claims 5 and 11*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Griepentrog et al (GB 2 050 679 A) (see IDS filed 10/12/04) in view of Nathenson et al (4,842,054).

On claim 5: Griepentrog et al teach (Figures 1 and 3) a device *capable of* producing electricity from the heat produced in the core (within 1) of at least one high-temperature nuclear reactor 1 comprising a primary circuit (i.e., closed circuit through 1 and 6, see page 3, lines 22-23) in which there circulates a first heat-exchange gas (*helium* gas, see page 3, l. 22) *capable of* cooling said core of said high-temperature reactor (examiner takes official notice heat is inherently produced in the core of any nuclear reactor, and that removal of heat in the high-temperature reactor, - as is evidently effected by said close circuit from the fact that said closed circuit runs through the high-temperature reactor (loc.cit.)), said primary (closed) circuit cools the core through thermal conductivity), a gas turbine 8 coupled to an electric generator 9 via a shaft (see Figure 1) (see page 3, l. 42-46) and a secondary circuit (page 3, l. 23-25; through duct 7)

capable of circulating a second heat exchange gas ("compressed gas" thereof, see page 3, l. 23-25) on which the gas turbine is inserted (see Figure 1);

at least one intermediate heat exchanger 6 having a primary portion connected to the primary circuit of the high-temperature nuclear reactor 1 (page 3, l. 22-30 and Figure 1) and a second portion to the secondary circuit (heat exchanger 6 overlaps both with 1 and the outside of 1 while being connected through duct 7; see Figure 1) and inherently *capable of* heating the second exchange gas on the basis of the heat produced in the reactor core and transported by the first heat exchange gas (namely: when conditions on the outside of 1 are lower than on the inside, which is generally true in operation). The intermediate heat exchanger 6 and the gas turbine 2 have characteristics adapted to the use of helium as first heat-exchange gas (as mentioned above, the first heat exchange gas *is helium*) and of a mixture of helium and nitrogen (N_2) as second heat-exchange gas (page 2, l. 48-55).

Griepentrog et al do not necessarily teach the further limitations of (a) "a tertiary circuit for circulation of water and steam, the tertiary circuit having at least one steam generator and at least one steam turbine" such that said steam generator comprises (b) "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine and a primary portion connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

However, it would have been obvious to include said further limitations in view of Nathenson et al, who, in a patent on high temperature nuclear reactor heat production

with two high-temperature heat exchange circuits 14 and 20 (title, abstract and col. 5, l. 59 – col. 6, l. 2 and col. 2, l. 57-62), hence analogous art, teaches a final steam loop 34 (col. 6, l. 17-25) meeting the limitation ad (a) above, i.e., "tertiary circuit", *capable of* "circulating water and steam" on which is disposed at least one steam generator 24 and at least one steam turbine 26 (col. 6, l. 17-25), while combination of the teaching by Nathenson et al with the invention by Griepentrog et al implies limitation ad (b) above, i.e., "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine (means: condenser 30; loc.cit.) and a primary portion heat exchanger enabling the steam generator 24; cf. Figure 1 and loc.cit.) connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

Motivation to include the teaching by Nathenson et al in the device by Griepentrog et al derives from the teaching of the improvement of the electrical efficiency of a further reduction of the temperature (col. 2, l. 62-64) and, furthermore, in the less demanding mechanical design parameters at reduced operating temperature (col. 2, l. 64-66). Finally, the introduction of the tertiary circuit enables a transformation of the usable energy in its most conventional form of steam thus being able to drive conventional generators of electricity.

On claim 11: in the combined invention the device comprises a moderate temperature heat exchanger (comprising and enabling steam generator 24 in Nathenson et al, Figure 1) (moderate for its temperature is lower than that in heat exchanger 6 in Griepentrob et al) having a first portion connected to secondary circuit

(which in Nathenson et al is circuit of intermediate loop 20 (Figure 1)) that *can be* (and is) *used* for circulation of the second exchange fluid in the moderate temperature heat exchanger (6 in Griepentrob et al, 16 in Nathenson et al (col. 5, l. 61 and Figure 1), and a secondary portion in which there circulates a liquid such as water (water is input into the steam generator) *used in* an auxiliary installation such as an urban heating circuit or seawater desalination plant.

In reference to the claim language referring to "used in" and (in italics for clarity above), intended use and other types of functional language must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In re Casey, 152 USPQ 235 (CCPA 1967); In re Otto , 136 USPQ 458, 459 (CCPA 1963). In the underlying case, said secondary circuit is actually used for the claimed purpose and a forteriori is capable of being used in that manner, while electricity from steam of capable of being used for any variety of purposes, the limitation thus clearly being *without any patentable weight.*

2. ***Claim 17 and 18*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Griepentrog et al (GB 2 050 679 A; previously cited and applied above to claims 5 and 11) and Nathenson et al (4,842,054; previously cited and as applied above to claims 5 and 11) in view of Naito et al (4,714,593).

<u>On claim 17:</u> *Griepentrog et al teach* (Figures 1 and 3) a device *capable of* producing electricity from the heat produced in the core (within 1) of at least one high-temperature nuclear reactor 1 comprising a primary circuit (i.e., closed circuit through 1

and 6, see page 3, lines 22-23) in which there circulates a first heat-exchange gas (*helium* gas, see page 3, l. 22) *capable of* cooling said core of said high-temperature reactor (examiner takes official notice heat is inherently produced in the core of any nuclear reactor, and that removal of heat in the high-temperature reactor, - as is evidently effected by said close circuit from the fact that said closed circuit runs through the high-temperature reactor (loc.cit.)), said primary (closed) circuit cools the core through thermal conductivity), a gas turbine 8 coupled to an electric generator 9 via a shaft (see Figure 1) (see page 3, l. 42-46) and a secondary circuit (page 3, l. 23-25; through duct 7) *capable of* circulating a second heat exchange gas ("compressed gas" thereof, see page 3, l. 23-25) on which the gas turbine is inserted (see Figure 1);

at least one intermediate heat exchanger 6 having a primary portion connected to the primary circuit of the high-temperature nuclear reactor 1 (page 3, l. 22-30 and Figure 1) and a second portion to the secondary circuit (heat exchanger 6 overlaps both with 1 and the outside of 1 while being connected through duct 7; see Figure 1) and inherently *capable of* heating the second exchange gas on the basis of the heat produced in the reactor core and transported by the first heat exchange gas (namely: when conditions on the outside of 1 are lower than on the inside, which is generally true in operation). The intermediate heat exchanger 6 and the gas turbine 2 have characteristics adapted to the use of helium as first heat-exchange gas (as mentioned above, the first heat exchange gas *is helium*) and of a mixture of helium and nitrogen (N_2) as second heat-exchange gas (page 2, l. 48-55).

Griepentrog et al do not necessarily teach the further limitations of (a) "a tertiary circuit for circulation of water and steam, the tertiary circuit having at least one steam generator and at least one steam turbine" such that said steam generator comprises (b) "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine and a primary portion connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

However, it would have been obvious to include said further limitations in view of Nathenson et al, who, in a patent on high temperature nuclear reactor heat production with two high-temperature heat exchange circuits 14 and 20 (title, abstract and col. 5, l. 59 – col. 6, l. 2 and col. 2, l. 57-62), hence analogous art, teaches a final steam loop 34 (col. 6, l. 17-25) meeting the limitation ad (a) above, i.e., "tertiary circuit", *capable of* "circulating water and steam" on which is disposed at least one steam generator 24 and at least one steam turbine 26 (col. 6, l. 17-25), while combination of the teaching by Nathenson et al with the invention by Griepentrog et al implies limitation ad (b) above, i.e., "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine (means: condenser 30; loc.cit.) and a primary portion heat exchanger enabling the steam generator 24; cf. Figure 1 and loc.cit.) connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

Motivation to include the teaching by Nathenson et al in the device by Griepentrog et al derives from the teaching of the improvement of the electrical

efficiency of a further reduction of the temperature (col. 2, l. 62-64) and, furthermore, in the less demanding mechanical design parameters at reduced operating temperature (col. 2, l. 64-66). Finally, the introduction of the tertiary circuit enables a transformation of the usable energy in its most conventional form of steam thus being able to drive conventional generators of electricity.

Neither Griepentrog et al nor Nathenson et al necessarily teach the limitation that the intermediate heat exchanger is a plate exchanger. However, plate heat exchangers have long been in use in the thermal power industry, as witnessed for instance by Naito et al, who, in a patent on heat exchange technology (title, abstract and col. 1, l. 5 – col. 2, l. 26), hence analogous in this regard to Griepentrog et al, teach a plate exchanger as a possible embodiment for heat exchanger 60 (Figures 1B and 5; and col. 9, l. 40-60). Hence all of the components recited in claim 17 are known, the only difference being the combination of old elements into a single device. Thus, it would have been obvious to one of ordinary skill in the art to select a plate exchanger, for instance a plate-fin exchanger, for the intermediate heat exchanger, since the operation of the plate exchanger is in no way dependent upon the operation of the other components, - because heat exchange of fluids with a plate surface or a plate-fin structure is effective regardless the fluid, given the large surface area available for heat exchange with a surface and/or fin, and given that both fluids involved in the intermediate exchanger by Griepentrog et al are characterized with positive thermal conductivity (see Abstract in Griepentrog et al, and see, for instance Chapman and Cowling, "Mathematical Theory of Non-Uniform Gases", 13.2, in particular Table 20 (see experimental values for helium

and nitrogen)). Given the exchange gas composition, and the sizable thermal diffusivities of the participating gases, the selection of a plate exchanger is obvious merely considering the large surface area over which the heat exchange takes place. Therefore, the claim would have been obvious because a person of ordinary skill has good reason (large surface area involved in the heat exchange) to pursue known options (including the tested plate exchanger or plate-fin exchanger) within his or her technical grasp. If this leads to the anticipated success, then it is likely the product not of innovation but of ordinary skill and common sense.

<u>*On claim 18:*</u> *Griepentrog et al teach* (Figures 1 and 3) a device *capable of* producing electricity from the heat produced in the core (within 1) of at least one high-temperature nuclear reactor 1 comprising a primary circuit (i.e., closed circuit through 1 and 6, see page 3, lines 22-23) in which there circulates a first heat-exchange gas (*helium* gas, see page 3, l. 22) *capable of* cooling said core of said high-temperature reactor (examiner takes official notice heat is inherently produced in the core of any nuclear reactor, and that removal of heat in the high-temperature reactor, - as is evidently effected by said close circuit from the fact that said closed circuit runs through the high-temperature reactor (loc.cit.)), said primary (closed) circuit cools the core through thermal conductivity), a gas turbine 8 coupled to an electric generator 9 via a shaft (see Figure 1) (see page 3, l. 42-46) and a secondary circuit (page 3, l. 23-25; through duct 7) *capable of* circulating a second heat exchange gas ("compressed gas" thereof, see page 3, l. 23-25) on which the gas turbine is inserted (see Figure 1);

at least one intermediate heat exchanger 6 having a primary portion connected to the primary circuit of the high-temperature nuclear reactor 1 (page 3, l. 22-30 and Figure 1) and a second portion to the secondary circuit (heat exchanger 6 overlaps both with 1 and the outside of 1 while being connected through duct 7; see Figure 1) and inherently *capable of* heating the second exchange gas on the basis of the heat produced in the reactor core and transported by the first heat exchange gas (namely: when conditions on the outside of 1 are lower than on the inside, which is generally true in operation). The intermediate heat exchanger 6 and the gas turbine 2 have characteristics adapted to the use of helium as first heat-exchange gas (as mentioned above, the first heat exchange gas *is helium*) and of a mixture of helium and nitrogen (N_2) as second heat-exchange gas (page 2, l. 48-55).

Griepentrog et al also teach the secondary circuit being entirely closed (page 2, lines 59-60) and including a compressor (either 14, 16, 18 or any combination thereof may be activated depending on the desired compression ratio; see Abstract and page 3, lines 47-57) *capable of* recompressing the second heat exchange gas to a desired or predetermined pressure level, prior to its reintroduction (page 3, line 55) at the inlet of the secondary portion of the intermediate exchanger. The limitation "substantially equal to the pressure of the first heat-exchange gas" does not carry patentable weight, limiting only the intended use of said compressor. Intended use and other types of functional language must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the

prior art structure is capable of performing the intended use, then it meets the claim. In re Casey,152 USPQ 235 (CCPA 1967); In re Otto , 136 USPQ 458, 459 (CCPA 1963).

Griepentrog et al do not necessarily teach the further limitations of (a) "a tertiary circuit for circulation of water and steam, the tertiary circuit having at least one steam generator and at least one steam turbine" such that said steam generator comprises (b) "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine and a primary portion connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

However, it would have been obvious to include said further limitations in view of Nathenson et al, who, in a patent on high temperature nuclear reactor heat production with two high-temperature heat exchange circuits 14 and 20 (title, abstract and col. 5, l. 59 – col. 6, l. 2 and col. 2, l. 57-62), hence analogous art, teaches a final steam loop 34 (col. 6, l. 17-25) meeting the limitation ad (a) above, i.e., "tertiary circuit", *capable of* "circulating water and steam" on which is disposed at least one steam generator 24 and at least one steam turbine 26 (col. 6, l. 17-25), while combination of the teaching by Nathenson et al with the invention by Griepentrog et al implies limitation ad (b) above, i.e., "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine (means: condenser 30; loc.cit.) and a primary portion heat exchanger enabling the steam generator 24; cf. Figure 1 and loc.cit.) connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

Motivation to include the teaching by Nathenson et al in the device by Griepentrog et al derives from the teaching of the improvement of the electrical efficiency of a further reduction of the temperature (col. 2, l. 62-64) and, furthermore, in the less demanding mechanical design parameters at reduced operating temperature (col. 2, l. 64-66). Finally, the introduction of the tertiary circuit enables a transformation of the usable energy in its most conventional form of steam thus being able to drive conventional generators of electricity.

Neither Griepentrog et al nor Nathenson et al necessarily teach the limitation that the intermediate heat exchanger is a plate exchanger. However, plate heat exchangers have long been in use in the thermal power industry, as witnessed for instance by Naito et al, who, in a patent on heat exchange technology (title, abstract and col. 1, l. 5 – col. 2, l. 26), hence analogous in this regard to Griepentrog et al, teach a plate exchanger as a possible embodiment for heat exchanger 60 (Figures 1B and 5; and col. 9, l. 40-60). Hence all of the components recited in claim 17 are known, the only difference being the combination of old elements into a single device. Thus, it would have been obvious to one of ordinary skill in the art to select a plate exchanger, for instance a plate-fin exchanger, for the intermediate heat exchanger, since the operation of the plate exchanger is in no way dependent upon the operation of the other components, -because heat exchange of fluids with a plate surface or a plate-fin structure is effective regardless the fluid, given the large surface area available for heat exchange with a surface and/or fin, and given that both fluids involved in the intermediate exchanger by Griepentrog et al are characterized with positive thermal conductivity (see Abstract in

Griepentrog et al, and see, for instance Chapman and Cowling, "Mathematical Theory of Non-Uniform Gases", 13.2, in particular Table 20 (see experimental values for helium and nitrogen)). Given the exchange gas composition, and the sizable thermal diffusivities of the participating gases, the selection of a plate exchanger is obvious in light of the large surface area over which the heat exchange takes place. Therefore, the claim would have been obvious because a person of ordinary skill has good reason (large surface area involved in the heat exchange) to pursue known options (including the tested plate exchanger or plate-fin exchanger) within his or her technical grasp. If this leads to the anticipated success, then it is likely the product not of innovation but of ordinary skill and common sense.

3. ***Claim 19*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Griepentrog et al, in view of Nathenson et al, Naito et al (all as cited above) and Sasayama et al (US 2001/0037652).

This rejection is offered subject to the noted indefiniteness under 35 U.S.C. 112, second paragraph under the assumption that the secondary circuit is closed if the any circuit interaction through the valve is left out of consideration. Under said assumption lack of enablement also is removed so there is no inconsistency between the art rejection and the rejection under 35 U.S.C. 112, first paragraph.

Griepentrog et al teach (Figures 1 and 3) a device *capable of* producing electricity from the heat produced in the core (within 1) of at least one high-temperature nuclear reactor 1 comprising a primary circuit (i.e., closed circuit through 1 and 6, see page 3, lines 22-23) in which there circulates a first heat-exchange gas (*helium* gas, see page 3,

l. 22) *capable of* cooling said core of said high-temperature reactor (examiner takes official notice heat is inherently produced in the core of any nuclear reactor, and that removal of heat in the high-temperature reactor, - as is evidently effected by said close circuit from the fact that said closed circuit runs through the high-temperature reactor (loc.cit.)), said primary (closed) circuit cools the core through thermal conductivity), a gas turbine 8 coupled to an electric generator 9 via a shaft (see Figure 1) (see page 3, l. 42-46) and a secondary circuit (page 3, l. 23-25; through duct 7) *capable of* circulating a second heat exchange gas ("compressed gas" thereof, see page 3, l. 23-25) on which the gas turbine is inserted (see Figure 1);

at least one intermediate heat exchanger 6 having a primary portion connected to the primary circuit of the high-temperature nuclear reactor 1 (page 3, l. 22-30 and Figure 1) and a second portion to the secondary circuit (heat exchanger 6 overlaps both with 1 and the outside of 1 while being connected through duct 7; see Figure 1) and inherently *capable of* heating the second exchange gas on the basis of the heat produced in the reactor core and transported by the first heat exchange gas (namely: when conditions on the outside of 1 are lower than on the inside, which is generally true in operation). The intermediate heat exchanger 6 and the gas turbine 2 have characteristics adapted to the use of helium as first heat-exchange gas (as mentioned above, the first heat exchange gas *is helium*) and of a mixture of helium and nitrogen (N_2) as second heat-exchange gas (page 2, l. 48-55).

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However, it would have been obvious to include said further limitations in view of Nathenson et al, who, in a patent on high temperature nuclear reactor heat production with two high-temperature heat exchange circuits 14 and 20 (title, abstract and col. 5, l. 59 – col. 6, l. 2 and col. 2, l. 57-62), hence analogous art, teaches a final steam loop 34 (col. 6, l. 17-25) meeting the limitation ad (a) above, i.e., “tertiary circuit”, *capable of*

"circulating water and steam" on which is disposed at least one steam generator 24 and at least one steam turbine 26 (col. 6, l. 17-25), while combination of the teaching by Nathenson et al with the invention by Griepentrog et al implies limitation ad (b) above, i.e., "a secondary portion connected to the tertiary steam and steam circuit to receive water at the inlet and to provide steam at the outlet to the steam turbine (means: condenser 30; loc.cit.) and a primary portion heat exchanger enabling the steam generator 24; cf. Figure 1 and loc.cit.) connected to the secondary circuit to receive the second exchange gas after it issues from the gas turbine".

Motivation to include the teaching by Nathenson et al in the device by Griepentrog et al derives from the teaching of the improvement of the electrical efficiency of a further reduction of the temperature (col. 2, l. 62-64) and, furthermore, in the less demanding mechanical design parameters at reduced operating temperature (col. 2, l. 64-66). Finally, the introduction of the tertiary circuit enables a transformation of the usable energy in its most conventional form of steam thus being able to drive conventional generators of electricity.

Neither Griepentrog et al nor Nathenson et al necessarily teach the limitation that the intermediate heat exchanger is a plate exchanger. However, plate heat exchangers have long been in use in the thermal power industry, as witnessed for instance by Naito et al, who, in a patent on heat exchange technology (title, abstract and col. 1, l. 5 – col. 2, l. 26), hence analogous in this regard to Griepentrog et al, teach a plate exchanger as a possible embodiment for heat exchanger 60 (Figures 1B and 5; and col. 9, l. 40-60). Hence all of the components recited in claim 17 are known, the only difference being

the combination of old elements into a single device. Thus, it would have been obvious to one of ordinary skill in the art to select a plate exchanger, for instance a plate-fin exchanger, for the intermediate heat exchanger, since the operation of the plate exchanger is in no way dependent upon the operation of the other components, - because heat exchange of fluids with a plate surface or a plate-fin structure is effective regardless the fluid, given the large surface area available for heat exchange with a surface and/or fin, and given that both fluids involved in the intermediate exchanger by Griepentrog et al are characterized with positive thermal conductivity (see Abstract in Griepentrog et al, and see, for instance Chapman and Cowling, "Mathematical Theory of Non-Uniform Gases", 13.2, in particular Table 20 (see experimental values for helium and nitrogen)). Given the exchange gas composition, and the sizable thermal diffusivities of the participating gases, the selection of a plate exchanger is obvious in light of the large surface area over which the heat exchange takes place. Therefore, the claim would have been obvious because a person of ordinary skill has good reason (large surface area involved in the heat exchange) to pursue known options (including the tested plate exchanger or plate-fin exchanger) within his or her technical grasp. If this leads to the anticipated success, then it is likely the product not of innovation but of ordinary skill and common sense.

Neither Griepentrog et al, nor Nathenson et al, nor Naito et al, necessarily teach the limitation on "at least one pressure equalizing valve" as claimed in the final six lines of the claim.

However, it would have been obvious to include said limitation in view of Sasayama et al, who, in a patent application publication drawn to a control device for a heat exchange process (title, abstract and [0001]-[0018]), hence, with regard to control of heat exchange process in art analogous to Griepentrog et al, teach a valve 14 being connected to the primary circuit 11 (through heat exchange portion 13: note that heat exchange takes place in circuit section 13) as well as to a conduit of a secondary circuit 12 so as to control the temperature of the primary heating medium 10 (see [0056] for all numerals introduced above, and see Figure 1). *Motivation* to include the valve 14 immediately derives from the stated purpose thereof by Sasayama et al, i.e., control of the heating medium, which in the invention by Griepentrog et al moreover adds to safety, as is known by those of ordinary skill in the nuclear art.

Response to Arguments

Applicant's arguments filed 2/26/07 and 6/7/07 have been fully considered but they are not persuasive. In particular:

As a preliminary matter and for the record, rather than "the examiner appreciated" that claims 6-10 should have been examined (Remarks, page 9), examiner indicated in the Interview (see Interview Summary mailed 1/18/07) that he "takes note of" Applicant's stated opinion to that effect and will "seriously consider" applicant's argument. Having seriously considered applicant's argument, examiner agrees to examine newly added claims 15-19 having effectively the same claim language as now cancelled claims 6-10, but declines responsibility for not having examined original

claims 6-10 in light of the conclusion that could reasonably be drawn from the Response filed 9/15/06 to the Restriction / Election-of-Species requirement mailed 3/24/06.

As to the issues on the merits:

Applicant's traverse on page 10, second paragraph, third and fourth paragraph, is not directed to specific claim language nor does it appear to connect to the rejection as included in the office action mailed 10/30/06, because said rejection is neither based on a teaching by Griepentrog of a tertiary circuit, nor on a compatibility of the actual embodiments of heat exchange fluids. The assertion (page 10, final paragraph) that thermodynamic cycles for a liquid metal cooled reactor are "completely different" exaggerates what needs to be learned from Nathenson et al, i.e., only the addition of a final, tertiary circuit in the form of a steam cycle 34 (see reference to col. 6, l. 17-25 in said Office Action). Whether said steam loop is at the low-temperature end of liquid metal cycles or gas cycles is irrelevant for the motivation because in both cases said steam loop offers an increase in electrical efficiency through reduction of the temperature of the respective metal or gas working fluids, which provides motivation to combine the teaching by Nathenson et al with the invention by Griepentrog. See the cited portion on col. 2, l. 62-64 in Nathenson et al. Additionally, see also col. 4, l. 38-47 to witness the key role of the steam in the cooling of the metal working fluid in Nathenson et al.

That Nathenson et al teach, according to Applicant (page 11, top paragraph) "nothing regarding how to solve problems related to the use of a turbine with a high expansion ratio in a secondary circuit" and that Nathenson (page 11, second paragraph)

"does not describe a water and steam tertiary circuit exchanging heat with a helium/nitrogen secondary circuit" (underscores added by examiner so as to highlight those aspects that are the focus for not being taught by Nathenson et al) is irrelevant because Nathenson et al was not cited for such teachings.

Applicant continues to insist (page 11, third paragraph) that the secondary circuit by Nathenson et al also needs to be included in the combination, although there is no reason for it: Griepentrog already has both turbines and a secondary circuit, and the question is only whether Nathenson et al renders a tertiary circuit obvious.

Counter to Applicant's argument of traverse on the extension of electrical efficiency increase by the use of three circuits as taught by Nathenson et al also to the nuclear reactor by Griepentrog (page 11, final paragraph), it is well known in the art of thermal power engines with helium and / or nitrogen as heat exchange fluids of Griepentrog that at least three cycles is advantageous for efficiency of the power cycle (see, e.g., Griepentrog (4,231,226), especially col. 1, l. 1`0-15, col. 2, l. 4-6 and col. 2, l. 67 – col. 3, l. 5, and Figure 1). It follows in particular and counter to Applicant's allegation on page 12, first paragraph, that, given the two cycles of Griepentrog as cited, one of ordinary skill in the art would expect that adding a third is advantageous for efficiency. In particular, it follows that, counter to Applicant's allegation on page 12, second paragraph, the electromagnetic pump by Nathenson et al is not at all crucial or central to the improved efficiency through the use of three cycles rather than two, as Griepentrog (4,231,226) does not rely on it and yet teaches the advantage of three cycles for power efficiency.

In view of the above, the rejections of claim 5 and 11 stand.

Claims 15-19 have been examined for the first and earliest time possible.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P. Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack W. Keith can be reached on 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JPM
August 29, 2007

Primary Patent Examiner:
Johannes Mondt (Art Unit: 3663)